Province of British Columbia
Ministry of Energy, Mines
and Petroleum Resources

MINERAL RESOURCES DIVISION
Geological Survey Branch

DEVELOPING TOMORROW'S MINERAL RESOURCES - NORTHWESTERN BRITISH COLUMBIA

By D.V. Lefebure and M.L. Malott

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92-00234/

SECOND ISKUT RIVER FIELD WORKSHOP

Geologists and prospectors are invited to attend the Iskut Field Workshop at the Bronson Creek airstrip in August 1991. The meeting will include six or seven talks, field trips and a barbecue. The talks will be presented by industry and research geologists who will focus on the mineral deposits and geology of the Iskut and Unuk River areas. The Workshop is being organized by the Ministry of Energy, Mines and Petroleum Resources and the Smithers Exploration Group. For more information contact Mary Lou Malott of the B.C. Geological Survey Branch at 847-7387.

NORTHWESTERN DISTRICT

By D.V. Lefebure and M.L. Malott
District Geology, Smithers

INTRODUCTION

Northwestern British Columbia was one of the most active mineral exploration areas in the country in 1990, with expenditures in excess of $110 million. This amounts to more than 60 per cent of all the dollars spent on exploration in the province. More encouraging results from the **Eskay Creek** property generated much of the action as 34 companies exploring in the Stewart - Iskut River area spent more than $51 million. The current surge of mineral exploration has lasted four years and has found numerous new mineral occurrences and defined new deposits.

The number of exploration programs increased in most areas throughout the Northwestern District. More companies were active in the region extending north from the Iskut River to the Galore Creek and Kiniskan Lake areas. Precious metal veins continued to be the principal target with some companies searching for polymetallic porphyry and volcanogenic massive sulphide deposits.

Construction of the surface facilities and development of the underground workings for the **Snip** gold deposit of Cominco Ltd. were almost complete by the end of the year. Mining of this deposit will start in early 1991. **Windy Craggy** and **Sulphurets** were the other two most advanced, active projects.

Eight mines continued production and one operation closed in 1990. The **Bell, Equity Silver, Cheni Gold, Shasta, Premier Gold, Golden Bear** and **Cassiar** mines operated throughout the year. Cassiar Mining Corporation removed the last ore from its open pit in June and by November had begun underground mining of asbestos fibre from the newly developed **McDame** deposit. The depletion of ore reserves at the **Johnny Mountain** gold mine led to its closure in September.

Crows Nest Resources Limited proposed mining plans for the Telkwa coal deposits; however, late in the year the company announced it was planning to sell its coal assets. The number of placer mining operations in the district declined 20 per cent from 1989, continuing a trend which started in 1988.

HIGHLIGHTS

- Geddes Resources Ltd. spent $11 million on the **Windy Craggy** copper deposit to complete a drilling program, mine planning studies and bulk sampling.
- At the **Midway** silver-lead-zinc deposit Regional Resources Ltd. extended the workings to the Discovery zone and carried out an underground drilling program.
- Cassiar Mining Corporation completed the development of the **McDame asbestos orebody** and started underground mining.
- Drilling on the **Tulsequah Chief property** resulted in a 50-metre intersection of precious metal-rich massive sulphides from the H lens.
- For the first time since the early 1970s, a large drilling program was completed on the **copper-gold Galore Creek deposit.**
- Cominco Ltd. started construction and underground development at the **Snip gold deposit** with production planned for early 1991.
- On the **Eskay Creek property** Calpine Resources Inc. spent $27 million to complete 485 diamond-drill holes, underground development and bulk sampling, with only helicopter access to the claims.
- Polymetallic mineralization was found on the **Ski, GNC and Sib properties** which are adjacent to Eskay Creek.
- Placer Dome Exploration Ltd. drilled 65 holes on the **Kerr copper-gold porphyry deposit.**
- Feasibility studies completed on the **Sulphurets gold-silver property** indicated the West zone was not economically attractive at current metal prices.
- Westmin Mining Ltd. signed a joint venture agreement with Tenajon Resources Corporation concerning the **Silver Butte deposit.**
- Underground development and exploration on the Cliff Creek zone at the **Cheni Gold mine** proved disappointing as ore reserves in the zone were reduced by 45 per cent.
- Exploration by Noranda Minerals Inc. at the **Bell mine and Granisle pit** outlined mineralization which

Plate 2-1. Geddes Resources Ltd. continued to work on developing the huge Windy Craggy copper deposit. The company completed numerous studies to assess the impact of a mine in this remote location, including field tests on the potential for developing acid drainage show in the picture above.

could significantly increase the reserves available for the Bell mill.

TRENDS

The mineral industry in northern British Columbia underwent a number of changes in 1990.

- Major companies became much more important.
- Companies developing major mines have kept the public more completely informed about their activities.
- Land-use issues proliferated and their potential impact on mineral exploration increased dramatically.

In the late 1980s mineral exploration was dominated by junior companies while the major companies played a secondary role. This year there was a marked change as major companies, such as Cominco Ltd., Homestake Mineral Development Co., Noranda Inc., Placer Dome Inc. and Westmin Resources Limited completed large exploration programs. In the 1990s it would appear that the major companies will play a larger role in exploring for mineral deposits and developing new mines.

In 1990, for the first time in British Columbia, a company, Geddes Resources Ltd. toured the province to explain its mining plans for the Windy Craggy copper deposit. While many projects do not require this level of public discussion, it is anticipated that in the next decade there will be increasing demands for information from mineral industry companies about proposed mine developments.

The pressure on British Columbia's land base also began to show in 1990, with a wide variety of new areas proposed for consideration as Wilderness Areas, Local Resource Use Plans, Recreation Corridors, Parks and other designations. Most of these initiatives will not alienate the land from mineral exploration. They will, however, place more constraints on how mineral exploration and mining can be carried out. During the next decade the mineral industry will be increasingly asked to participate in land-use decisions.

The regional infrastructure in northwestern British Columbia continued to improve with the completion of the Bob Quinn airstrip in August. Numerous companies were using the airstrip by the end of the field season and as many as five helicopters were based at the strip. Nearby Bob Quinn Lake will be the starting point for the 92-

Plate 2-2. Located near the Yukon border, a $7.5 million underground development and drilling program was completed on the Discovery Zone of the Midway manto deposit.

Plate 2-3. Underground development at Eskay Creek started in June and include mining of a bulk sample (pictured above) for metallurgical tests.

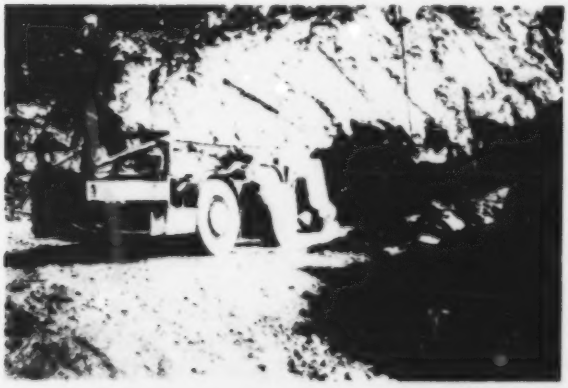


Plate 2-4. In the Toodoggone the Sable Resources Ltd. shifted to underground mining of the JM and Creek zones from two underground levels. The portal to the Creek zone is shown above.

kilometre Iskut road. Field studies for this road were completed in October. It will follow the Iskut River to the Bronson Creek airstrip (near Cominco's Snip project) with a spur along Volcano Creek to provide access to the Eskay Creek property. Construction of the Iskut Road is planned to start in 1991.

OPPORTUNITIES

Areas with excellent exploration potential are still open for staking throughout the Northwestern District. Some of the more attractive exploration targets are the porphyry copper-gold deposits in the Stikine and Quesnel terranes, volcanogenic massive sulphide deposits in the Alexander and Stikine terranes, and mesothermal gold deposits in the Alexander Terrane.

Porphyry copper-gold deposits, such as Galore Creek, Kerr and the Bell orebody, are found throughout the Stikine Terrane. Current exploration is focused on the Quesnel trough and northern part of the Stikine Terrane. There is excellent potential in southern Stikinia, particularly in the Babine Lake area. The northern extension of the Quesnel Terrane into the Dease Lake area also holds some promise.

A number of volcanic belts in the Northwestern District are underexplored for volcanogenic massive sulphide deposits. Recent exploration results at Windy Craggy and the Tulsequah Chief mine, as well as the development of the new Greens Creek mine in Alaska, have generated more interest in this deposit type. Areas with massive sulphide potential include the Tatshenshini River, Cry Lake, Dundas Island and Ecstall River districts.

Current work on the Eskay Creek deposit suggests it is primarily a volcanogenic massive sulphide deposit with very high precious metal contents. Exploration for similar deposits in the Stikine Terrane is attracting a lot of exploration funding. Middle Jurassic submarine strata elsewhere within this terrane are prospective for similar deposits.

The North Coast was again one of the quietest areas in the province with respect to mineral exploration, despite the potential to find major mesothermal gold veins.

MINERAL EXPLORATION

Mineral exploration expenditures for the Northwestern District soared to $110 million, more than 60 per cent of the provincial total (Figure 2-1). More than $51 million was spent in the Stewart - Iskut River "Golden Triangle", where the focus was on the $29 million **Eskay Creek** program. Except for the **Windy Craggy** project,

virtually all the other large projects were located within the Stikine Terrane. Excluding the Eskay Creek and Windy Craggy projects, the average expenditure for a project with drilling or underground development was $644 000.

A total of 622 Notices of Work were submitted in 1990 for mineral exploration, up 40 per cent from 1989 (Figure 2-2). Eight per cent of the Notices were revisions to previously submitted programs. A total of 99 major projects in the district were explored by drilling, underground development or major surface programs (Figure 2-3). A complete list of all the major exploration programs is presented in Table 2-1 and Figures 2-4 and 2-5. The following material is a review of the 1990 exploration activity completed in the various parts of the Northwestern District. The descriptions start with properties located in the northwest and move generally to the southeast.

TATSHENSHINI RIVER AREA

In the extreme northwestern corner of the province a $12 million program was completed on the **Windy Craggy** property of Geddes Resources Ltd. Windy Craggy is a volcanogenic massive sulphide deposit with similarities to both the Besshi and Cyprus types. The mineralization is hosted by Triassic clastic sediments and mafic flows and sills. It occurs near the transition from a predominantly clastic host to overlying mafic volcanic rocks. The North and the South orebodies have a combined strike length of 1.6 kilometres and extend 600 metres below the surface. Each of the zones has a surface expression of supergene copper sulphide enrichment overlain by gossan caps rich in gold and silver. Reserves are currently estimated at 210 million tonnes of 1.59 per cent copper at a 0.5 per cent copper cut-off (Table 2-1).

Environmental and geotechnical studies necessary for mine planning, as well as drifting and drilling, were completed in 1990. Drilling between the North and South zones located the new Ridge zone which has been traced along strike for 390 metres. Geddes Resources has revised its Stage 1 report for the provincial government to better address several issues, including potential acid rock drainage.

Seventy kilometres northeast of Windy Craggy, Goldbank Ventures Ltd. outlined a volcanogenic massive sulphide target on the **Bar** property. The baritic zone contains auriferous pyrite, sphalerite, chalcopyrite, galena and argentite mineralization.

ATLIN

On the **Atlin Ruffner** property of Homestake Mineral Development Company, exploration focused on the South Vulcan zone and #6 vein. Both these zones are hosted by the Fourth of July Creek batholith. The South Vulcan Creek zone is characterized by quartz veins and stockworks in quartz-sericite-altered granodiorite of the Fourth of July Creek batholith. One mineralized interval returned values of 260.2 grams per tonne silver over 0.45 metre. Silicified, chloritized and sheared mafic dikes host the #6 vein which has a strike length exceeding 1600 metres. The best assay from the eastern extension of the vein is an intercept grading 36.3 grams per tonne silver, 20.5 per cent lead and 6.5 per cent zinc over a true width of 0.6 metre.

Noranda Exploration Company, Limited explored for lode gold on the **Pinelode** property on Pine Creek, an important placer gold producer. The property is believed to be underlain by gold-bearing listwanitic alteration zones which occur at a contact between ultramafic intrusive rocks and andesitic volcanic rocks. Unfortunately the drilling intersected only barren ultramafic rocks.

Northwest of Atlin, between Bennett and Tutshi lakes, Lodestar Explorations Inc. discovered two large hydrothermally altered zones in metamorphic rocks of the Yukon Group on the **Pavey** property. Called the Skarn and Cowboy zones, they were drilled and returned assays ranging from 1.23 grams per tonne gold over 29.9 metres to 9.09 grams per tonne gold over 2.99 metres.

Approximately 45 kilometres west of Atlin, on the **TP (Teepee)** property, Cyprus Gold Ltd. drilled several veins cutting Proterozoic-Paleozoic metamorphic rocks close to the Llewellyn fault.

CASSIAR

In the Cassiar mining camp **Total Energold Corporation** used geophysical surveys over its extensive property holdings to trace thrust contacts between argillite and volcanic-chert units within the Sylvester allochthon. These thrust faults were systematically drilled to identify alteration zones and find hidden ore zones. The Bain vein, discovered in 1989, was extended another 300 metres, for a total of strike length of 500 metres, and remains open to the east. Drilling located two other weakly mineralized veins on the Erickson property.

The **Midway** manto deposit is located just south of the Yukon border and 85 kilometres west of Watson Lake. The 1990 exploration program consisted of extending the underground workings by a decline from the Silver Creek zone to the Discovery zone, to provide access for more than 5000 metres of underground drilling. The deposit is hosted by McDame Group carbonates and occurs up to 30 metres below the contact with the overlying Earn Group shale. Mineralization consists of an irregular system of pipes filled with pyrite, sphalerite, galena, pyrrhotite, friebergite, arsenopyrite, pyrargyrite

MAJOR EXPLORATION PROGRAMS

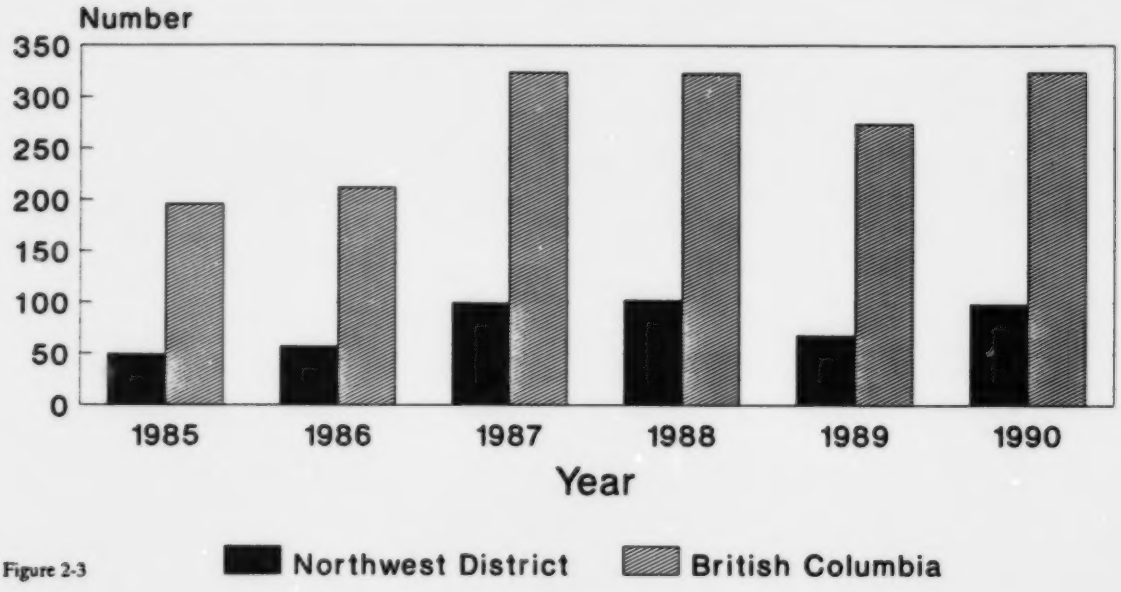
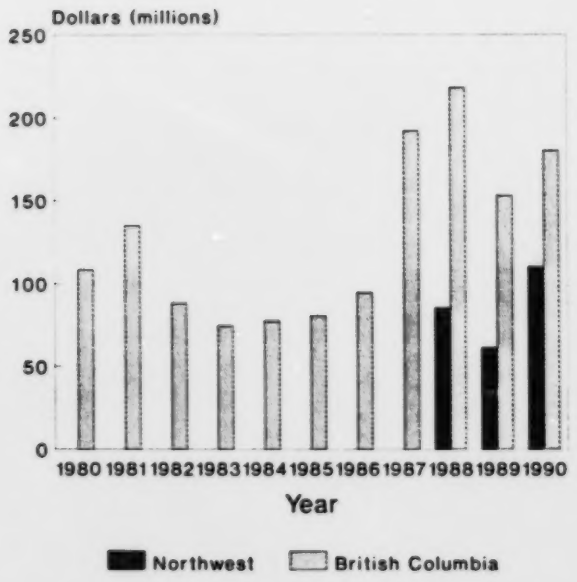


Figure 2-3

MINERAL EXPLORATION EXPENDITURES



Provincial figures for 1980 to 1989 provided by B.C. and Yukon Chamber. 1990 figure from District Geologists.

Figure 2-1

MINERAL NOTICES OF WORK Northwestern British Columbia

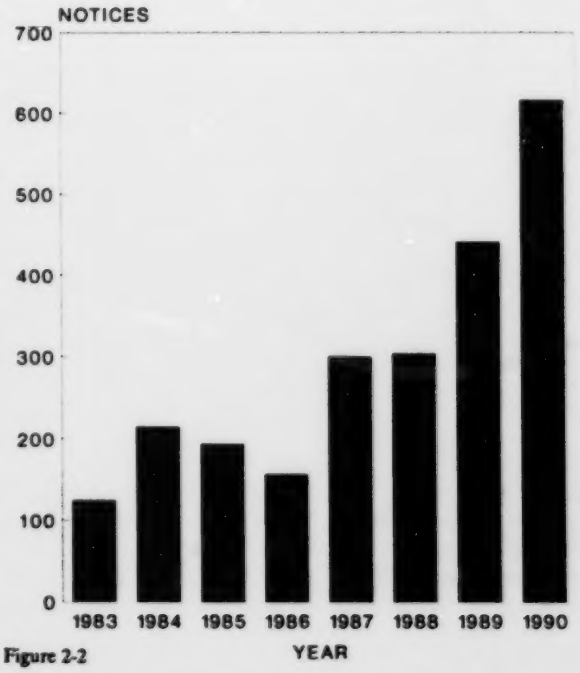


Figure 2-2

Figure 2-4

MAJOR EXPLORATION PROGRAMS NORTHWESTERN BRITISH COLUMBIA 1990

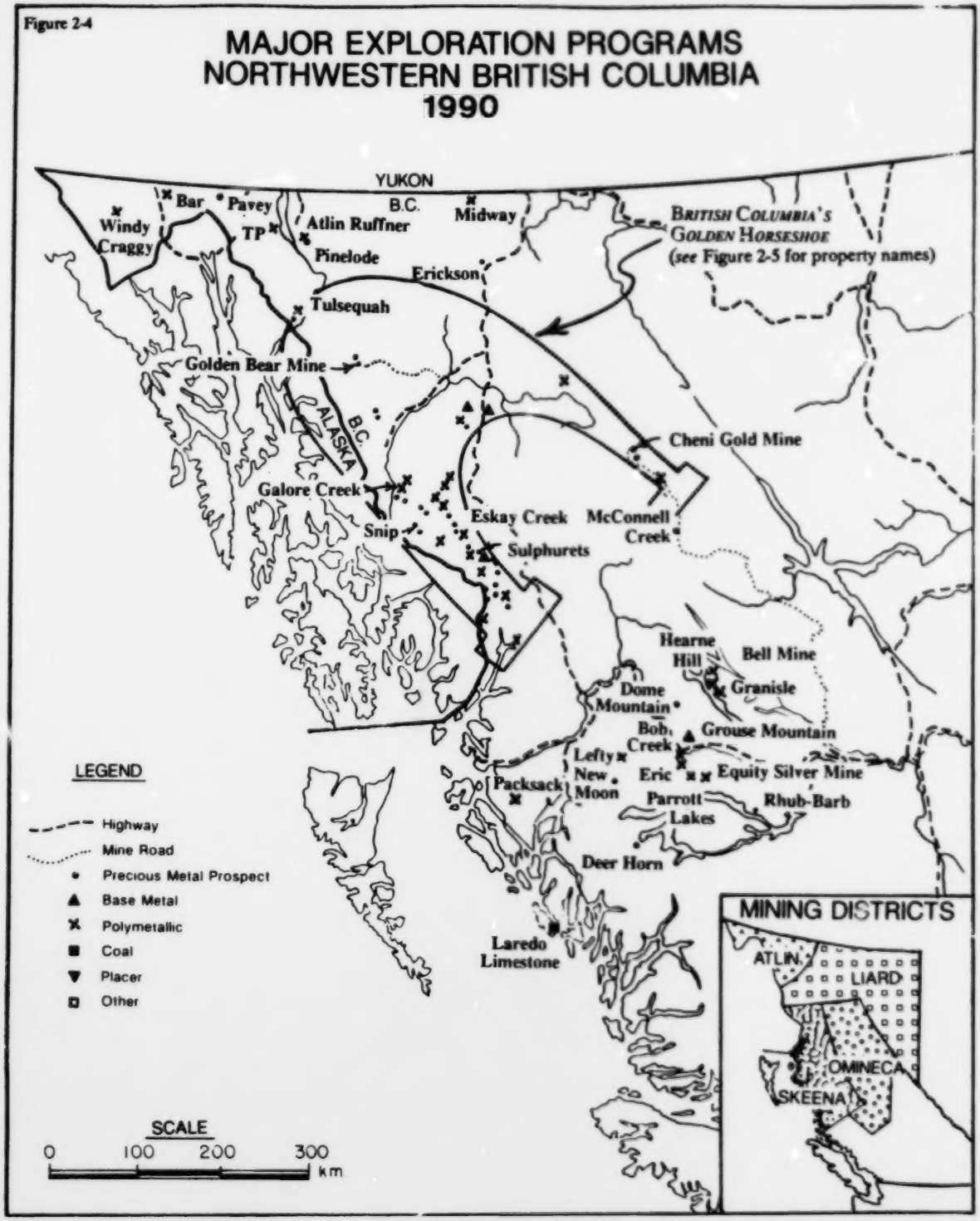


TABLE 2-1
DEVELOPMENT STAGE PROJECTS
NORTHWESTERN DISTRICT, BRITISH COLUMBIA

PROJECT	COMPANY	ORE RESERVES
Windy Craggy	Geddes Resources Ltd.	143 Mt; 1.69% Cu, 0.084% Co, 0.2 g/t Au 3.41 g/t Ag (proven and probable)
Eskay Creek	Corona Corp., Placer Dome Inc.	3.967 Mt; 26.4 g/t Au 998.4 g/t Ag, Pb,Zn,Cu (probable and possible)
Sulphurets	Newhawk Gold Mines Ltd., Granduc Mines Limited	West Zone 648.6 kt; 14.77 g/t Au, 675.4 g/t Ag (proven plus probable)
Silver Butte	Tenajon Resources Corp., Westmin Mining. Ltd.	279.4 kt; 17.31 g/t Au 36.68 g/t Ag
Telkwa Coal	Shell Canada Ltd.	South Telkwa: 21.8 Mt North Telkwa: 13.2 mt bituminous coal

and tin and lead sulphosalts. The geology is disrupted by north-trending faults and several new mineralized zones were intersected by drilling. Drilling in the early 1980s resulted in estimated geological reserves of 1.185 million tonnes grading 410 grams per tonne silver, 9.6 per cent zinc and 7 per cent lead within the Discovery and Silver Creek zones.

BRITISH COLUMBIA'S "GOLDEN HORSESHOE"

The Stewart-Iskut River and Toodoggone River areas are only part of the northern Stikine Terrane which has potential for major precious metal deposits related to island-arc volcanic centres. The Galore Creek, Kiniskan Lake and other areas have well-demonstrated potential for large gold, copper and silver deposits. This area can be considered to be British Columbia's "Golden Horseshoe" because northern Stikinia forms a horseshoe-shaped border to the Bowser basin (Figure 2-4). This area includes the much smaller "Golden Triangle" which has Johnny Mountain, Sulpurets and Stewart at the corners.

Exploration programs in the Tulsequah River, Tatsamenie Lake, Dease Lake, Mount Edziza, Galore Creek, Forrest Kerr, Iskut River, Eskay Creek, Unuk River, Sulphurets, Stewart, Alice Arm and Toodoggone areas all lie within the Golden Horseshoe. Expenditures on 77 major exploration programs within the Horseshoe were in excess of $83 million in 1990.

TULSEQUAH RIVER - TATSAMENIE LAKE AREA

The **Tulsequah Chief** property of Cominco Ltd. and Redfern Resources Ltd. is located 65 kilometres northeast of Juneau, Alaska. The 1990 drilling program was designed to test for the new H ore lens lying above the previously known A and B lenses. Drill intersections of the horizons were approximately 300 metres deeper than last year's drilling. In July, Cominco intersected 50 metres of massive sulphides grading 2.92 per cent copper, 1.58 per cent lead, 9.09 per cent zinc, 3.83 grams per tonne gold and 170 grams per tonne silver in the H lens. Other massive sulphide intersections were made during the program, although in many cases they were partially displaced by a diorite dike. The 1990 results are expected to boost the geologically indicated reserves reported by Redfern Resources in 1989 (*see* Table 2-2).

Just across the Tulsequah river, at the old **Polaris-Taku** gold mine, Suntac Minerals Corporation completed a drilling program in early 1990 which was followed up later in the year with surface surveys by Estey Agencies Ltd. The early program tested the strike and down-dip continuity of the east-trending C vein, a quartz-carbonate shear zone containing veins impregnated with auriferous arsenopyrite. Reported assay results from drill intersections varied between 2.16 grams per tonne gold over 9 metres to 51.02 grams per tonne gold over 3 metres. The drilling added 332 000 tonnes to the reserves which now total 803 765 tonnes (probable and possible) grading 16.11 grams gold per tonne.

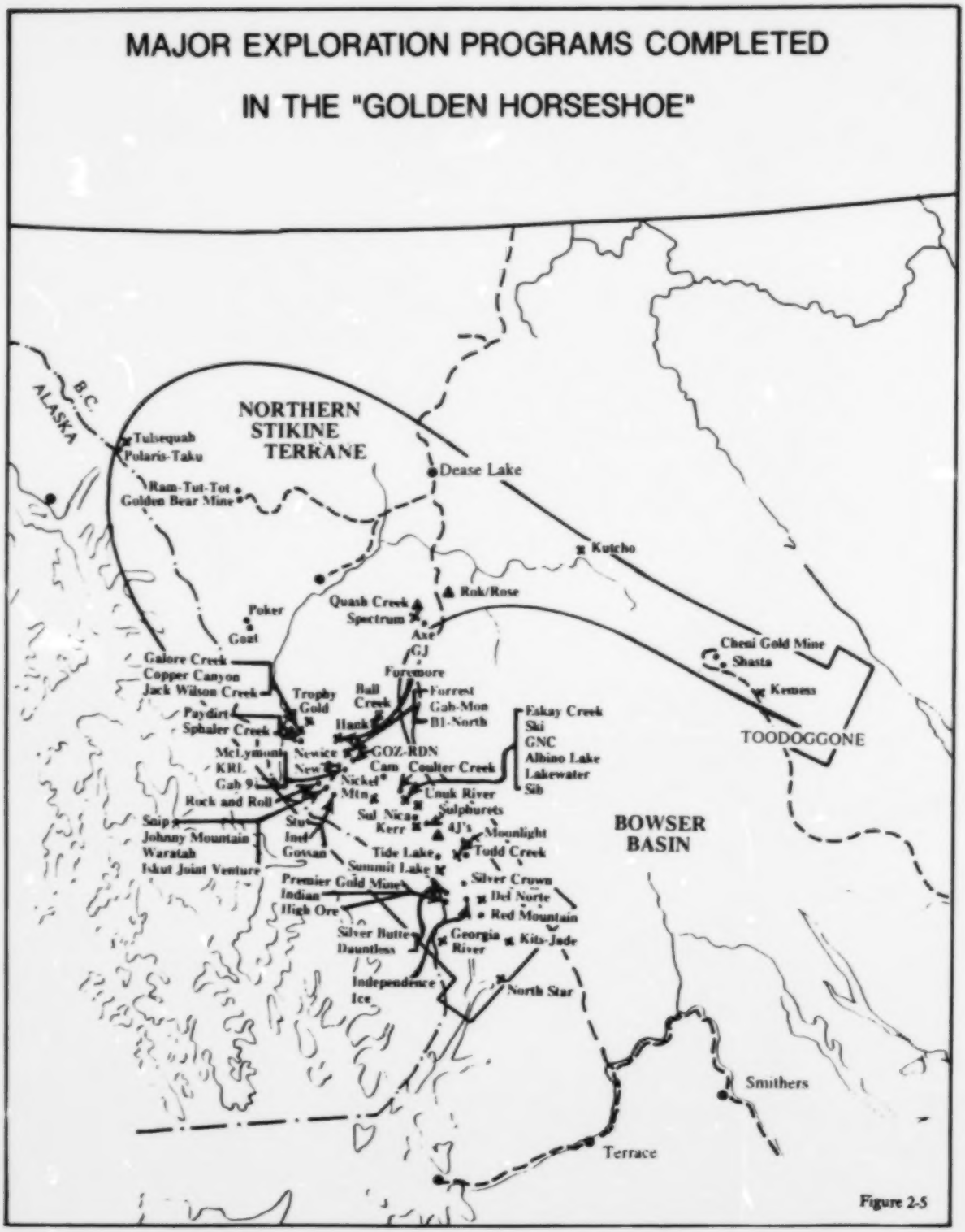

MAJOR EXPLORATION PROGRAMS COMPLETED
IN THE "GOLDEN HORSESHOE"
B.C.
ALASKA
NORTHERN
STIKINE
TERRANE
Tulsequah
Polaris-Taku
Ram-Tut-Tot
Golden Bear Mine
Dease Lake
Kutcho
Rok/Rose
Quash Creek
Spectrum
Poker
Goat
Axe
GJ
Galore Creek
Copper Canyon
Jack Wilson Creek
Paydirt
Sphaler Creek
Trophy
Gold
Ball
Creek
Foremore
Forrest
Gah-Mon
Bl-North
Hank
McLymont
KRL
Gab 9
Newice
New T
GOZ-RDN
Cam
Nickel
Mtn
Coulter Creek
Unuk River
Sulphurets
Sul Nicas
Kerr
4J's
Moonlight
Todd Creek
Tide Lake
Summit Lake
Rock and Roll
Snip
Johnny Mountain
Waratah
Iskut Joint Venture
Stu
Ind
Gossan
Premier Gold Mine
Indian
High Ore
Silver Butte
Dauntless
Georgia
River
Independence
Ice
Silver Crown
Del Norte
Red Mountain
Kits-Jade
North Star
Eskay Creek
Ski
GNC
Albino Lake
Lakewater
Sib
Cheni Gold Mine
Shasta
Kemess
TOODOGGONE
BOWSER
BASIN
Smithers
Terrace

Figure 2-5

TABLE 2-2
ADVANCED EXPLORATION PROJECTS,
NORTHWESTERN DISTRICT, BRITISH COLUMBIA

PROJECT	COMPANY	ORE RESERVES
Midway	Regional Resources Ltd.	1 185 Mt; 410 g/t Ag, 7.0 % Pb, 9.6 % Zn
Tulsequah	Cominco Ltd., Redfern Resources Ltd.	5.26 Mt; 1.6% Cu, 1.31% Pb, 7.03% Zn, 2.74 g/t Au, 100.5 g/t Ag
Erickson Gold	Total Energold Corp.	Erickson:18.3 kt; 14.1 g/t Au Cusac, Michelle Ext.: 25 kt; 34.29 g/t Au, 12.3 g/t Ag
Kerr	Western Canadian Mining Corp., Sulphurets Gold Corp.	114.3 Mt (drill inferred); 0.61% Cu, 0.27 g/t Au, 1.71 g/t Ag
Dome Mountain	Teeshin Resources Ltd. Canadian-United Minerals Inc.	293.9 kt; 12.17 g/t Au, 80.23 g/t Ag

At the **Golden Bear** mine there was drilling north and south of the Bear main zone to locate extensions to the orebody. Results indicate that the host structure extends a considerable distance to the south. This area is largely untested. Drill results to the north indicate the potential for significant mineralization hosted in an en echelon fault which parallels the Bear Mine fault. Approximately 10 kilometres northwest of the Golden Bear mine, Armeno Resources Inc. investigated a zone of silicification and brecciation extending 1.5 kilometres along a limestone-phyllite contact on the **Tut** property. Strongly anomalous gold, silver, arsenic and antimony values were returned from the silicified zone which can be up to 50 metres thick.

In the Barrington River region, two projects were completed in an area underlain by interlayered volcanics and sediments of the Stuhini Group. These conformable units have been intruded by a multiphase syenitic intrusion which is enveloped by a large hornfels zone. The syenite has a variety of associated mineral occurrences, including porphyry copper-gold mineralization. On the **Poker** property surveys were completed by Dryden Resource Corporation to try to locate the source of glacial boulders found below Limpoke Glacier. Drill holes testing UTEM and magnetic anomalies on the south side of the valley produced no significant results. On the nearby **Goat** property the exploration program concentrated on known showings. Fifteen zones have significant concentrations of gold-copper mineralization, while numerous lenses of massive arsenopyrite and pyrrhotite with high gold values over narrow widths were found in other areas.

DEASE LAKE - MOUNT EDZIZA AREA

At the **Kutcho** property, located approximately 100 kilometres southeast of Dease Lake, Homestake Mineral Development Company completed a major drilling program over virtually an entire greenstone belt. The target was volcanogenic massive sulphide deposits similar to the **Kutcho Creek** deposit. Favourable hydrothermal alteration was found at numerous locations on the property, however, a pyrite bed 1 to 2 metres thick was the only new horizon discovered. It was intersected in four holes over a 3.5-kilometre strike length along the southwestern side of the property. No new mineralized sulphide lenses were defined.

There were a number of exploration programs in the Kiniskan Lake area. Near Eddontenajon, Manchester Resources Corporation drilled the Main showing on the **Rok** property. The third hole intersected chalcopyrite mineralization near the top of the hole, including a 6.0-metre interval of 4.25 per cent copper and 7.13 grams gold per tonne. Farther to the west, on Teck Corporation's **Quash Creek** property, drilling was focused on a strong copper-gold soil anomaly in the vicinity of a porphyritic stock intruding Stuhini Group volcanics.

On the nearby **Spectrum** property, the target is porphyry gold-copper mineralization associated with an altered zone in Stuhini Group volcanics and sediments. Previous work on the property was concentrated on the Red Dog zone where earlier drilling had outlined 1.8 million tonnes of 1.37 grams per tonne gold . In 1990, initial drilling by Columbia Gold Mines Ltd. tested the 500 Colour, Porphyry and QC zones. These zones trend northerly and dip steeply. They are associated with a large

alteration system of intensely silicified and carbonatized andesitic tuffs containing pyrite, arsenopyrite and visible gold.

Adjoining the Quash property to the south are the **Axe** claims of Ascot Resources Ltd., and farther south, the **Axe** property of Beauchamps Exploration Inc. The Axe properties cover Upper Triassic volcanics and coeval subvolcanic intrusives. Positive results were obtained on the Ascot property where high-grade copper mineralization with significant gold and arsenic values was discovered over an area 500 by 400 metres at Trevor Peak. Nearby, on the **GJ** property, a similar copper-gold porphyry target, with diorite to latite dikes and subvolcanic plugs, is hosted by coeval upper Triassic volcanics and cherts, to siltstones of possible Paleozoic age. The drilling, by Ascot Resources Ltd., tested along strike from known mineralization as well as several new targets. Results were considerably poorer than in earlier drilling programs, with the best interval grading 0.18 per cent copper and 0.34 gram per tonne gold over 27 metres.

GALORE CREEK AREA

The Galore Creek district was an active area with exploration for porphyry and vein deposits continuing. A two-phase drilling program was completed by Mingold Resources Inc. on the **Galore Creek** deposit. Initial drilling tested several gold targets peripheral to the main deposits. The second phase was concentrated on the Southwest zone.

The Copper Canyon showing immediately to the east of Galore Creek, was drilled by Consolidated Rhodes Resources Ltd. Preliminary reserves of 29 million tons grading 0.7 per cent copper, 9.33 grams per tonne silver and 0.311 gram per tonne gold were outlined in 1957. The 1990 drilling repeated some of the old holes and returned similar values over widths of tens to hundreds of metres. Other holes stepped out to define the margins of the deposits.

On the **Trophy Gold** property drilling tested the Ptarmigan zone and the N110 Grid, a large copper-gold soil anomaly coincident with induced polarization chargeability highs. Gigi Resources Ltd. reported gold and silver values from the Ptarmigan zone over widths of approximately 1 metre. Low-grade gold mineralization was intersected on the N110 Grid.

The **Jack Wilson Creek** property is located west of Galore Creek. It is underlain by strongly sheared, Triassic Stuhini volcanics and dioritic intrusives which are pervasively altered to chlorite and epidote, and locally to quartz, anhydrite and potassium feldspar. The strongest copper-gold mineralization appears to be at the juncture of fractures, faults and shears. The mineralization and associated alteration appears consistent with a high-level copper-gold porphyry model. The best copper-gold values found to date are in the Central zone where a 45-metre section grades 0.237 per cent copper and 0.377 gram per tonne gold .

On the fringes and south of the Galore Creek area the **Paydirt** and **Sphaler Creek** properties were explored for veins. At Sphaler Creek, Pass Lake Resources Ltd. drilled on coincident geophysical and geochemical anomalies on the Deluxe zone without intersecting any significant mineralization. Silver Standard Resources Inc. carried out an extensive mapping, geochemical and geophysical program on the Paydirt property.

FORREST KERR AREA

The **Ball Creek** property is a porphyry copper-gold system in an Upper Triassic package of andesitic tuffs, flows and epiclastics intruded by a swarm of subparallel, north-trending Late Triassic monzonite dikes. A circular hypabyssal monzonite stock is also believed to underlie the property. Alteration consists of a potassic core (Camp zone) grading outwards into concentric phyllic and then propylitic shells. Earlier drilling outlined a large area of promising gold and copper values. The 1990 drilling tested geophysical and geochemical targets, unfortunately results were not encouraging.

On the nearby **Hank** property, owned by Lac Minerals Ltd., the lower alteration zone was tested along strike for the extension of the broad pervasive area of pyritic alteration with quartz stringers and veins containing galena, sphalerite, chalcopyrite and pyrite which characterizes the zone. No significant zones of gold mineralization were found.

Massive sulphide boulders in the **More Creek** area generated considerable excitement as several companies searched for their source. Cominco Ltd. followed up on its 1989 surface exploration program and drilled five holes through Foremore Glacier. The holes were to test for the bedrock source of massive sulphide boulders at both toes of the glacier. The stratigraphic sequence (from top to bottom) intersected in drilling is: gabbro, laminated argillite, limy tuff, graphitic schist, chert, maroon and green intermediate pyroclastics with interfoliated quartz-sericite-pyrite schist. The sequence has undergone two periods of penetrative deformation and is thought to be Devono-Mississippian in age. On the adjoining **GOZ-RDN** property to the south, Noranda Exploration Company, Limited followed up another boulder train. Drill testing of selected targets yielded mixed results which ranged from 7.89 grams per tonne gold over 7.85 metres to 11.6 grams per tonne gold over 4.4 metres.

Avondale Resources Ltd. continued work on a number of prospects on the **Forrest Kerr** property, including the Creek showing. The latter is a large area of gold-sil-

ver-copper mineralization within a quartz stockwork. Twenty-four holes were drilled on eight targets.

Five gold-bearing zones were explored on the **Gab-Mon** property of Consolidated Seagold Ltd., including the extension of the Northwest zone on the **McLymont** property. On the Northwest zone low gold values were obtained in fractures in Mississippian volcanics, but no limestone units were found. The **Arseno/Sulphide** zone was the only prospect drilled with the best intersection containing 5.07 grams per tonne gold over 2.2 metres. Kestrel Resources Ltd. drilled two holes to test a geophysical anomaly on the nearby **B1-North** property. No significant mineralization was encountered.

NEWMONT LAKE AREA

The Northwest zone of the **McLymont** property was drilled extensively by Gulf International Minerals Ltd. It is now believed to be a gold-enriched retrograde-altered skarn. Jasper, hematite, carbonate, quartz and rare remnants of andradite garnet with associated gold have replaced units of coarse crinoidal marble. Galena-lead isotope analyses indicate an Early Jurassic, or older age. Zones with similar alteration patterns have been identified elsewhere on the property.

On the adjacent **Gab 9** claims, held by Jazzman Resources Inc., a thick succession of Mississippian volcanic, volcaniclastic and bioclastic rocks underlies the property. The exploration target is a gently dipping crinoidal limestone occurring near steeply dipping faults associated with the regional McLymont fault. Dolomitization, silicification and chlorite alteration are associated with widespread pyrite. Gold is primarily confined to silicified and sericitized zones in recrystallized limestone as seen on the adjoining McLymont property. The most significant results include an assay of 11.6 grams per tonne gold over 1 metre within a strong geochemically anomalous zone 80 metres thick.

On the **KRL** property, located near the McLymont property, Kestrel Resources Ltd. drill-tested a series of quartz veins carrying visible gold. A number of drill holes cut short sections assaying up to 34 grams per tonne gold. Northwest of the McLymont area, Ticker Tape Resources Inc., on the **Newice** property, and Adrian Resources Ltd., on the **New** claims, drilled a series of gold-bearing quartz veins. They report no significant results.

ISKUT RIVER AREA

The **Rock and Roll** property of Thios Resources Ltd. is centred on some rocky knolls near the confluence of the Craig and Iskut rivers. The Black Dog zone has massive pyrite, galena, sphalerite and chalcopyrite mineralization in a subvertical shear zone. Immediately to the east, on ground controlled by the Iskut Joint Venture, gold occurs in variably carbonate-altered and sheared pyritic volcanic rocks and/or narrow quartz-carbonate veins. Drilling tested three zones in two phases. The best result was an intersection assaying 8.98 grams per tonne gold over 1.37 metres obtained from the Gregor zone.

Underground development and surface construction continued at Cominco Ltd.'s **Snip** deposit, in preparation for the commencement of mining operations in 1991 (*see* section on Development Projects). On nearby Johnny Mountain, a large exploration program was completed by Skyline Gold Corporation on the **Johnny Mountain Flats** area. High gold values were found in a 1.5-metre quartz vein at the C1 zone and in a mineralized shear zone called the Burnie. In addition Skyline worked with Placer Dome Exploration Inc. in a joint venture covering the **Reg** claims which cover the Bronson Creek and Bonanza West prospects. Polymetallic mineralization was discovered in a shear zone (the Bonanza zone) which lies along the extension of the structural zone hosting the Snip deposit.

Big M Resources Ltd. worked on the **Waratah** property, located just east of the confluence of the Iskut River and Bronson Creek. The program consisted of surface trenching and drilling on the Cooper occurrence, a gold-bearing shear zone.

To the south, on the **Inel** property, Gulf International Minerals Ltd. completed an underground development and drilling program on the AK zone, in conjunction with Avondale Resources Inc. The pyrite, sphalerite, galena, chalcopyrite and arsenopyrite mineralization is hosted by a syenitic intrusive breccia. The mineralized breccia was traced over a strike length of about 150 metres. Two of the best drill-hole intersections were 7.4 metres grading 41.14 grams per tonne gold and 9.2 metres grading 18.17 grams per tonne gold. The highest gold values seem to be concentrated along one horizon at about the 1690-metre elevation.

On the nearby **Stu** property, Kestrel Resources Ltd. drilled high-grade veins in two separate areas. To the east, on the adjoining **Cam** claims of Crimsonstar Resources Ltd. and Florin Resources Inc., pyrite, pyrrhotite, chalcopyrite and arsenopyrite, with magnetite and hematite, were intersected in drilling on a strong geochemical anomaly. The mineralization may be similar to skarns found on the adjacent **Josh** claims.

The **Gossan** claims in the Khyber Pass area, south of Inel, are underlain by sediments and volcanics of the Lower Jurassic Betty Creek and Unuk River formations. These units have been intruded by megacrystic feldspar-porphyritic diorite and an equigranular monzonite. Vector Industries International Inc. drill-tested the Pyramid Hill skarn, Zinc Hill and 'A' zones. The A zone, first drilled in 1985, is interpreted to be a conformable horizon

Plate 2-5. Exploration in rugged northwestern British Columbia continued at a record pace in 1990. On the Eskay Creek property more than $25 million dollars was spent on this rich gold-silver deposit which is accessible only by helicopter.

at the base of an andesitic unit and overlying a siltstone. The Zinc Hill zone is located northeast of the A zone and has a similar style of mineralization. A 54.4-metre intersection on the A zone returned values of 1.10 grams gold and 10.29 grams per tonne silver, 0.05 per cent copper and 0.42 per cent zinc.

A 1988 airborne magnetometer survey over the **Nickel Mountain** property of Silver Standard Resources Inc. was followed up late in 1990 by a short drilling program testing two pronounced anomalies. Swift Minerals Ltd. drilled five holes on the nearby **Coulter Creek** property.

ESKAY CREEK AREA

Exploration continued at full bore on the **Eskay Creek** property with expenditures in excess of $25 million, the biggest program in British Columbia in 1990. Work was concentrated on infill drilling on the 21B zone, previously known as the Central zone, and its strike extension to the north. A step-out drilling program tested mineralization discovered on the 'C' and Pump zones to the west and east of the 21B zone, respectively. During the second half of the year an underground program included 1000 metres of drifting, and two crosscuts in ore, providing a bulk sample for metallurgical testing. The project entered the Mine Development Review Process with submission of a Prospectus in April. During 1990 Road access and environmental studies were undertaken for a Stage I report which is scheduled to be submitted in the spring of 1991.

Current estimated tonnages for the 21B and parts of the 21C and Pumphouse Lake zones, using a 3.42 grams per tonne gold cut off, are a geological reserve of 3.967 million tonnes grading 26.4 grams per tonne gold and 998.4 grams per tonne silver plus significant zinc and lead values. The deposits are hosted by argillaceous sedimentary rocks within the lowest member of the Salmon River Formation and partly within a footwall sequence of rhyolites of the Mount Dillworth Formation. The 21B zone is now recognized to be a volcanogenic massive sulphide deposit.

Drilling by Adrian Resources Ltd. further defined reserves on the **Tok** claim "gap" which is surrounded by the Eskay Creek property. These reserves are part of the 21B deposit but are reported separately as 153 314 tonnes grading 22.63 grams gold and 598.98 grams silver per tonne at a 3.42 grams gold cut off. Adrian Resources also drilled on its **Ski** property to the north and east of the Eskay Creek project. Lower grade mineralization was traced along strike from the 21B zone for several hundred metres onto this property. The zone is deeper toward the northeast.

On the **GNC** claims, which are located to the east and west of the Eskay Creek property, Prime Resources Group Inc. focused its drilling on the Tip Top and Porphyry showings. The latter is a base metal zone with gold

and silver values, adjacent to a feldspar porphyry intrusion. Adjoining the GNC property to the west, the **Lakewater** holdings of Tymar Resources Inc. were also drilled for possible down-dip extensions of the Eskay Creek deposit.

The **Albino Lake** project of Eurus Resources Corp. abuts the Eskay Creek property on the northwest. A winter drilling program is testing for the down-dip extensions of the 21C and 21B zones. The **Sib** property of American Fibre Corporation adjoins the Eskay property to the southwest. Intensely altered volcanic rocks host stockwork and vein-breccia mineralization within the 4.2-kilometre-long gossanous Central anomalous zone. Drilling cut numerous intercepts of 0.34 to 3.09 grams per tonne gold . Two hundred and fifty metres west of the Central zone and five kilometres south of the Eskay Creek property, an intersection in the Lulu zone averaged 14.43 grams gold and 1059.85 grams silver per tonne over 14.3 metres. The mineralization is in a graphitic mudstone interbedded with felsic volcanics.

Sulphurets Creek Area

Granges Inc. worked its large Unuk River property south of the Eskay Creek area which covers a number of prospects. Exploration focused on the **R grid**, **Zone 1/AP zone**, **U2 grid** and **Beedee zone**. Thirteen holes were completed on Zone 1 and three holes on the R grid. Short, subeconomic, polymetallic mineralized intervals were encountered in brecciated welded tuffs in the Zone 1/AP zone. No significant mineralization was encountered in R-grid drill holes which intersected minor felsic tuffs in a dominantly argillitic and andesitic sequence.

In the Sulphurets Creek area, drilling on the **Nica** claims by Ambergate Explorations Inc. produced little encouragement. Exploration on the nearby **Sul** claims by Kenrich Mining Corporation also did not find any significant showings.

On the **Kerr** property, more than 17 000 metres of drilling was done, on a porphyry target, by Placer Dome Exploration Inc. Mineralization and alteration occurs in Triassic volcanics and sediments intruded by subvolcanic alkaline intrusives. Disseminations and veinlets of chalcopyrite with lesser chalcocite, tenantite and bornite occur in a shear zone 90 to 100 metres wide within a north-trending sericitic alteration zone. Average grades of 0.8 per cent copper and 0.034 gram per tonne gold have been traced for a strike length of 1 kilometre and to a depth of 400 metres. Reserves based on 1989 information are quoted as 114.3 million tonnes grading 0.61 per cent copper, 0.27 gram gold and 1.71 grams silver per tonne.

Immediately to the east, on the **Sulphurets** property, Newhawk Gold Mines Ltd. completed underground drilling during the winter which extended the R8 vein system to the south and at depth, and the West zone deeper and to the north.

Stewart Mining Camp

Teuton Resources Ltd. discovered a 600 by 200-metre gold anomaly in soils on the 4Js property, 50 kilometres north of Stewart. Drilling beneath the anomaly intersected mineralization containing from 2.37 grams gold per tonne over 7.2 metres to 7.82 grams gold per tonne over 1 metre. At **Tide Lake**, Tenajon Resources Ltd. trenched and drilled the 73-metre-long 'A' structure. Surface chip samples averaged 20.5 grams gold and 6.86 grams silver per tonne over a width of 1.16 metres.

At the **Summit** property, the former Scottie Gold mine, Royal Scot Resources Ltd. conducted a surface and underground program testing the E, C and M zones. Continuity of the M zone was confirmed below the 3000 level.

A zone of vein-breccia replacement zone with polymetallic sulphides, 600 metres long, occurs on the **Silver Crown** property of Nararre Resource Corporation. The mineralization is hosted by what are believed to be mid-Jurassic siltstones and greywackes overlying well-stratified epiclastics of the Mount Dillworth felsic volcanic sequence.

Tenajon Resources Ltd. completed a drilling program which extended and confirmed the continuity of the Kansas and West Kansas zones on the **Silver Butte** property. Sulphide mineralization occurs in a quartz-carbonate stockwork hosted by Hazelton Group andesites. In October, Tenajon Resources and Westmin Mining Limited signed a joint venture agreement on the property, which is situated a kilometre southwest of the **Big Missouri mine** site. Milling the high-grade ore from the Silver Butte is expected to improve the overall economics of the **Premier Gold mine** operation. Westmin is currently evaluating drill data on the Facecut and West Kansas zones provided by a drilling program completed in September and October. Data from drilling on the **Dauntless** claim, adjacent to the Silver Butte, are also being evaluated.

Westmin continued to explore for new ore reserves. On the **Silbak Premier** deposit, the 4G area of the 4 level was rehabilitated and an extensive underground drilling program undertaken. Westmin also drilled the **Indian** and **High Ore** properties.

In the Mount Shorty Stevenson area, Armeno Resources Inc. drilled north and south of the workings on the main structure of the **Independence** property. To the north, the silver mineralization was tested at depth and along strike. Testing to the south was for gold mineralization at depth.

On the **Ice** claims the target is a brecciated vein with quartz and sulphides, hosted by Lower Jurassic Unuk River Formation volcaniclastics and intercalated tuffaceous sandstones. Core from 50 centimetres of one hole assayed 1.79 grams gold and 343.0 grams silver per tonne, and 9.24 per cent zinc.

In the Todd Creek drainage, Noranda Exploration Company, Limited drilled coincident induced polarization and geochemical anomalies on the **Fall Creek** zone. The zone is a hydrothermally altered and mineralized area within a felsic volcanic and volcaniclastic package believed to be part of the Mount Dillworth Formation. On the **Moonlight** property, a few kilometres to the west, High Frontier Resources Ltd. drilled a quartz vein within a mineralized zone at the contact of volcanic and sedimentary rocks of what is believed to be the Lower Jurassic Unuk River Formation.

Approximately 15 kilometres east of Stewart, Teuton Resources Corporation evaluated a series of base and precious metal zones characterized by metal-rich veins and gold-copper-rich replacement horizons. The hostrocks are thought to be Middle Jurassic volcaniclastic and epiclastic rocks of the Betty Creek Formation which are flanked on either side by Salmon River Formation sedimentary rocks. Both units are intruded by a plagioclase hornblende porphyry. The mineralization appears to occur at the sediment-volcanic contact.

Bond Gold Canada Inc. drilled near **Red Mountain**. Although little information is available about this property, preliminary data suggest that this is a mesothermal vein system, possibly related to a porphyry system. Approximately 25 kilometres south of Stewart, Bond Gold Canada also undertook a program on the **Georgia River** property.

ALICE ARM AREA

At the head of the Kitsault valley, Oliver Gold Corporation conducted a large geophysical and geochemical program on the **Kits-Jade** property. The focus of exploration has moved from narrow, high-grade lead-silver shear veins to large-tonnage, stratiform zinc-lead-silver targets. Broad zones of porphyry copper-gold mineralization have also been outlined.

Dolly Varden Minerals Inc. drilled for massive sulphides in a wide area of conformable barite mineralization. The sporadic zinc-copper-lead-gold values encountered are interpreted by Dolly Varden Minerals geologists as a distal facies of a sulphide lens.

NORTH COAST

Cominco Ltd. drilled the **Packsack** property in the Ecstall River area to test continuity of the known massive sulphide horizon at depth.

The limestone quarry on **Aristazabal Island**, owned by Laredo Limestone Ltd., was drilled to confirm reserves and limestone quality.

TODOGGONE RIVER AREA

Gold-silver epithermal veins hosted by Triassic Takla Group and Lower Jurassic Toodoggone volcanics (equivalent to the Hazelton Group) have remained the focus of exploration in the area. On the southeastern border of the camp porphyry copper-gold mineralization is the target.

Cheni Gold Mines Inc. conducted an extensive exploration program on the **Lawyers** property. The AGB zone was drilled in the West and Blasthole segments. The deposit contains a hematite zone grading into a silicic then propylitic zone with depth. The Duke's Ridge zone was tested for a down-dip extension of the structure. The entire Cliff Creek zone was drilled. Both the South and Mid areas within the Cliff Creek zone are more complicated than originally thought. The mineralization is associated with narrow breccia zones which seem to act as conduits for ore-forming fluids. The veins appear to be tension gashes between the breccia zones.

On the **Shasta** property, mineralization is hosted predominantly by feldspar quartz crystal-lapilli tuffs informally named the "pyroclastic series" of the Toodoggone Formation. Volcaniclastics overlying the pyroclastic series appear to postdate the mineralization. The mineralization can be characterized as tabular to curviplanar quartz-calcite breccia zones within an area of variable alteration and stockwork veining. Drilling results on the Creek zone were encouraging for Homestake Minerals Ltd.; it was extended along strike and now has a 1000-metre length, 200-metre down-dip extent and an average thickness of 6 metres.

South of the Toodoggone and east of Thutade Lake, El Condor Resources Ltd. explored for porphyry copper-gold mineralization on the **North** and **South Kemess** properties.

The **North Kemess** property, east of Duncan Lake, was drilled to test the mineralization in intensely hydrothermally altered diorite plutons and Takla volcanics. These rocks host auriferous porphyry copper mineralization within phyllic and potassic alteration zones that are surrounded by extensive propylitic alteration. Drilling on the **South Kemess**, which is south of Duncan Lake, gave encouraging results ranging from 0.03 gram per tonne gold and 0.19 per cent copper over 40.6

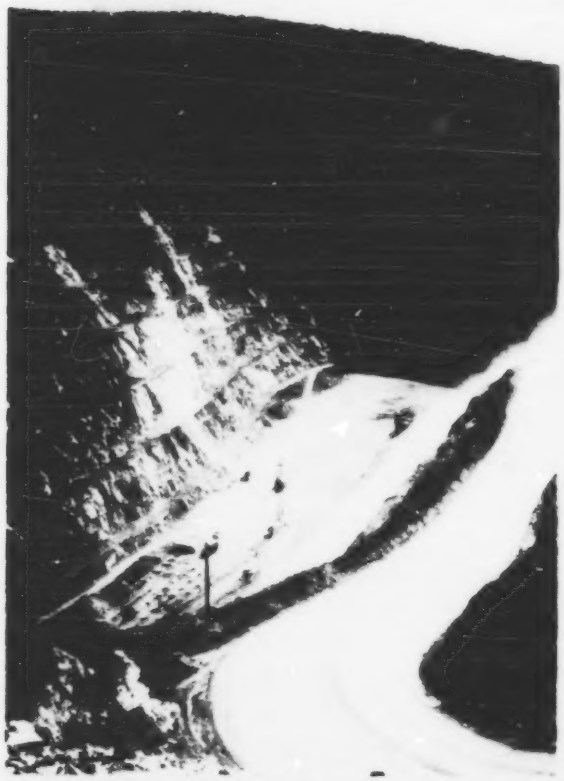


Plate 2-6. At the Equity Silver Mine mining operations focussed on the Main Zone pit (shown above) with development and initial mining of the Waterline Zone pit. Current ore reserves at Equity Silver are projected to be exhausted by late 1992.

metres to 0.83 gram per tonne gold and 0.31 per cent copper over 161.72 metres. The host stock, a complex monzonite-diorite that is variably quartz bearing and strongly altered and quartz veined, intrudes Takla volcanics and interbedded sediments.

BABINE LAKE AREA

Noranda Minerals Inc. carried out three exploration programs in the Babine Lake area. At the **Bell mine site**, Noranda drilled 52 holes within and adjacent to the pit in order to better define ore and waste zones. An additional 10 holes were drilled to the north and west of the pit to define areas suitable for future waste-rock dumps. For the first time in a number of years, Noranda Minerals worked on the **Granisle property**. Drilling was to confirm the grade and tonnage calculations determined from drill and blasthole data which collected prior to the closure of the Granisle mine, and also to define waste zones within the core of the deposit. A few holes tested the possibility of pushing back the north wall of the pit. On the **Hearne Hill** property, drilling by Noranda for the last two years has been targeted on an altered, chalcopyrite-bearing breccia pipe within a Tertiary biotite feldspar porphyry. Part of a larger zone of low-grade, fracture controlled mineralization, the pipe extends to 120 metres below surface where it is cut off by a postmineral quartz feldspar porphyry dike.

SMITHERS - HOUSTON AREA

Drilling on the **Dome Mountain** property of Teeshin Resources Ltd., 25 kilometres east of Smithers, outlined a continuation of the main ore zone and increased the length of the Boulder shear zone. Significant intersections were encountered throughout the 350-metre extension of the Boulder zone. In November, Teeshin Resources announced the signing of a joint venture agreement with Timmins Nickel Inc. whereby the latter company is to bring the property into production.

North of Houston, copper showings on the **Grouse Mountain** property were drilled by Swift Minerals Ltd.

Equity Silver Mines Ltd. explored both at the mine site south of Houston and on a number of properties within the region. At the mine site, drilling the down-dip extension of the southern end of the Main zone, intersected several narrow intervals of erratic high-grade copper-silver-gold mineralization. Ten kilometres south of Houston, Equity Silver drilled an alteration zone on the northeast side of **Bob Creek**. Four holes intersected strongly clay-altered zones with weak mineralization averaging 0.3 gram per tonne, gold with assays sporadically reaching 2.9 grams per tonne gold. The **Eric** copper-silver showing in a Lower Jurassic Hazelton Group lapilli tuff was the drill target of another Equity Silver program south of Houston. The stratabound mineralization consists of pyrite, tetrahedrite, galena and traces of chalcopyrite and sphalerite within the tuff.

On the **Parrott Lakes** project, south of Houston, Territorial Drilling Ltd. drill tested a zone of zinc-silver mineralization.

On the northeast side of Ootsa Lake, Mingold Resources Inc. intersected several epithermal zones of intense silicification and brecciation in drilling on the **Rhub-Barb** property. The hostrocks are Lower Tertiary Ootsa Lake Group volcanics. Assay values are up to 1.371 grams per tonne gold over 0.70 metre.

In the Burnie Lakes area Equity Silver Mines Ltd. drilled several copper-silver-gold showings on the **Lefty** Property which are hosted hosted in rhyolitic flows and andesites of the Lower Jurassic Hazelton Group. The mineralization consists of disseminations of chalcopyrite, tetrahedrite and sphalerite.

Eighty kilometres southwest of Houston, Maple Resource Corporation conducted follow-up drilling on two mineralized areas on the **New Moon** property.

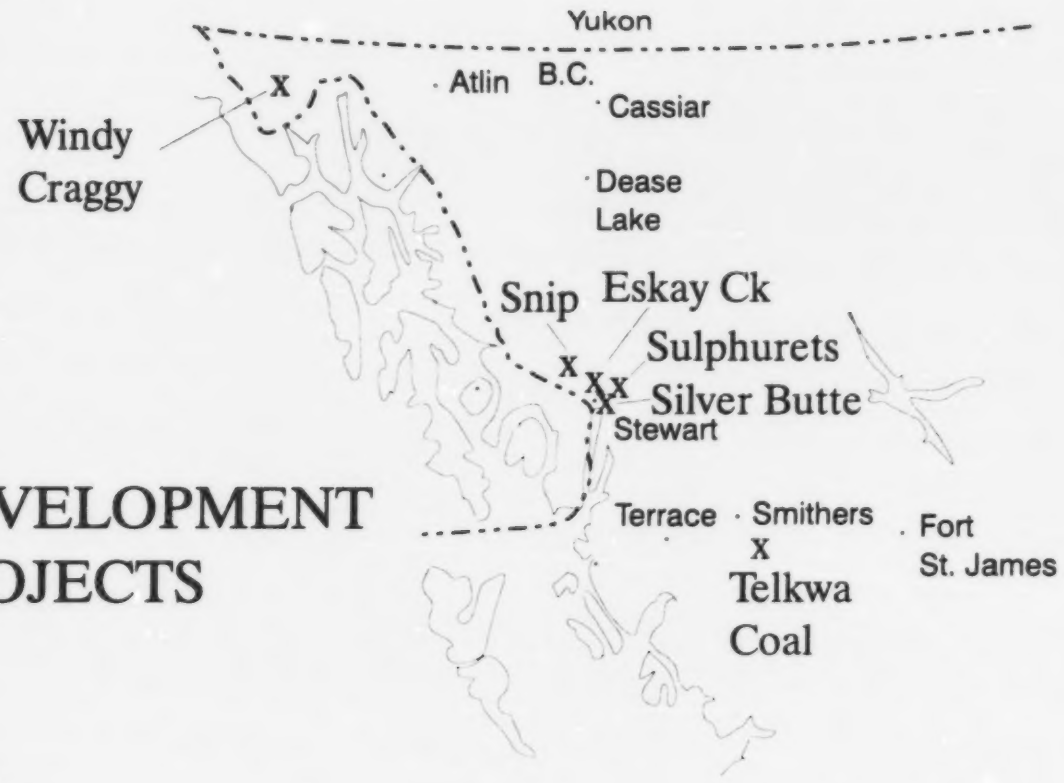


Figure 2-6

Silicification and shearing at, or close to, the contact between rhyolite and andesite flows returned values up to 12.89 grams per tonne gold across 2 metres. The Main zone of stringer to semimassive base and precious metals mineralization was also tested.

WHITESAIL LAKE AREA

Although there are a number of known porphyry deposits in the Whitesail region, major exploration activity in the area has been limited for the past several years. Golden Knight Resources Inc. completed the last half of a $1 million program to assess the potential of the old **Deer Horn mine** situated within the Tweedsmuir Recreation Area.

COAL

The **Telkwa** property of Crows Nest Resources Limited was the only active coal project in the Northwestern District in 1990. Crows Nest submitted a revised Stage 2 report early in the year. The mine plan focuses on the bituminous coal deposits on the north side of the Telkwa River in the vicinity of Pine Creek. Plans were outlined to develop the deposits near Goathorn Creek on the south side of the Telkwa River towards the end of the life of the mine. In December, the company announced plans to phase out its coal operations and closed its office in Smithers.

PLACER

Placer activity decreased 20 per cent from the preceeding year, to 59 Notices of Work for the Northwestern District. Thirty-three of the notices were from the **Atlin** Mining Division, including 26 from the Atlin placer camp. The busiest area was **Spruce Creek** with six operations. In the Liard Mining Division there were 29 placer Notices of Work filed with three operators on each of **Dease**, **McDame** and **Rosella** creeks.

DEVELOPMENT PROJECTS

A number of projects were in the provincial government's **Mine Development Review Process** at the end of 1990. Active projects were Eskay Creek, Silver Butte, Snip, Sulphurets, Telkwa Coal and Windy Craggy (*see* Figure 2-6, Table 2-3). The Snip deposit was the only project for which the company had announced a production decision. Telkwa Coal has already been discussed in the section dealing with coal.

TABLE 2-3
ACTIVE MINES IN THE NORTHWEST DISTRICT, 1990

PROPERTY NAME (OWNER)	TONNES MILLED (000's)	RATED CAPACITY (TPD)	%ANNUAL RATED CAPACITY	DEPOSIT TYPE	RESERVES/PRODUCTION
Golden Bear (Golden Bear Op. Co.)	61.2	360	50	Vein Au	488 706 grams Au; for period Jan. to Nov.
Cassiar Mine (Cassiar Min. Corp.)	960	3600	91	Ultramafic asbestos	Mined out in June 1990; produced 2 603 692 tonnes of asbestos fibre from 1953 to 1990. Underground mining started on the McDame deposit in November.
Johnny Mountain (Skyline Gold Corp.)	96.9	350	92	Mesothermal vein Au-Ag-Cu	Suspended operations in August; 1 188 079 grams grams Au, 1 699 118 grams Ag, 271.5 tonnes Cu; for for period Jan. to Aug.
Premier Gold (Westmin Mines Ltd.)	620.5	2000	100	Epithermal vein Au-Ag	1284 kg Au, 14 825 kg Ag; for period Jan. to Oct.
Lawyers (Cheni Gold Mines Ltd.)	175.3	500	100	Epithermal vein Au-Ag	1488 kg Au, 33 455 kg Ag for period Jan. to Nov.
Shasta (Sable Resources Ltd.)	53.6	181	89	Epithermal vein Au-Ag	237 kg Au, 11 784 kg Ag for period Jan.-Nov.
Bell Mine (Noranda Minerals Inc.)	4957	14402	93	Porphyry Cu-Au	825 kg Au, 2989 kg Ag 43 537 747 lbs Cu
Equity Silver (Equity Silver Mines Ltd.)	2621.6	9000	96	Transitional Ag-Au-Cu	200 530 kg Ag, 1797 kg Au 5 293 200 kg Cu for period Jan. to Oct.

The **Snip** gold mine of Cominco Ltd. was under construction in late 1990 with startup planned for early 1991. The government Approval-in-Principle was granted in January 1990. Onsite construction started in June, although several buildings had been completed the previous year. The work included driving a 1-kilometre haulage adit at the 130 level and preparing the tailings impoundment area. A refitted 300 tonne per day mill was barged to the site. The mill will recover gold and silver metals from a gravity separation circuit and in concentrate from a sulphide floatation circuit. Many supplies for the mine site have been shipped in from Wrangell by hovercraft which will carry concentrate to Wrangell on the return trips after the mine opens.

Newhawk Gold Mines Ltd. completed a winter drilling program on the **Sulphurets** property. The drilling followed the West and R8 zones along strike and deeper. Cominco Engineering Services Ltd. and Fluor Daniel Wright Engineers Ltd. both completed feasibility studies. The latter study determined that a 317 tonne per day operation would entail a capital cost of $42.7 million with estimated direct operating costs of $130 per tonne. At the current metal prices the Sulphurets project was not deemed to be economic by Fluor Daniel Wright Engineers. The project has completed Stage I of the Mine Development Review process; the next step would be Stage III.

During the summer Geddes Resources Ltd. completed a large program, costing more than $10 million, to facilitate mine planning for the Windy Craggy deposit. A major drilling program located the Ridge ore zone, a new discovery, between the North and South orebodies. Engineering, environmental and glaciology studies were completed. There were also ongoing studies to assess the acid generation potential of the waste rock. A Stage I report was submitted to the Mine Development Review Committee in January, 1990. It was followed by a revised Mine Plan for the Stage I proposal in November. Two series of open-house meetings for the general public were organized by the company to help disseminate information about the proposed mine. The meetings were held in communities in British Columbia, Alaska and the Yukon in May and November.

An extensive exploration program, costing approximately $29 million dollars, was completed on the **Eskay Creek** property by Prime Resources Group Inc.

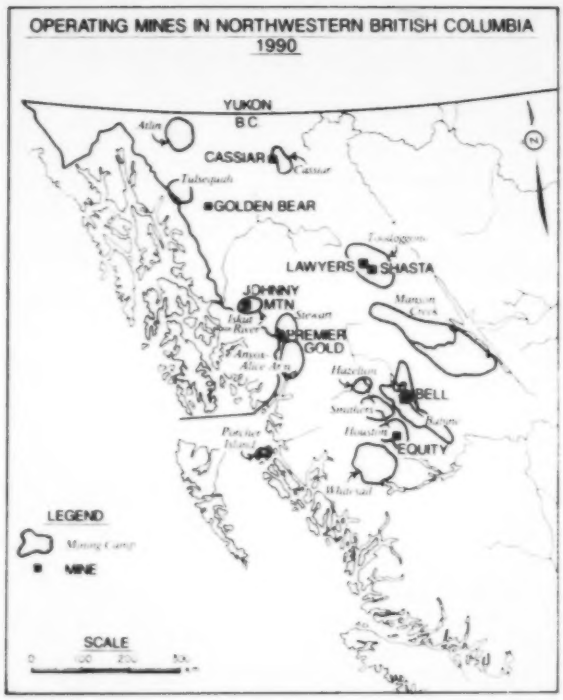


Figure 2-7

(*see* description above). A prospectus was submitted to the Mine Development Review Committee in April, 1990. A variety of terrain, engineering and environmental studies were carried out during the summer to establish mill and tailings pond locations. A 10-kilometre road route, which would link the property to the proposed Iskut road, was surveyed. A takeover battle for ownership of the property ended with Corona Corporation in charge and Placer Dome Inc. the other major owner. The Mine Development Review Committee was told to expect a Stage I report in the spring of 1991.

Exploration on the **Silver Butte** property has outlined 279 400 tonnes grading 17.14 grams gold and 36.7 grams silver per tonne. In October Westmin Mines Limited entered into a joint venture with the owner Tenajon Resources Ltd. to develop the orebody to provide feed for the Premier mill.

OPERATING MINES

During 1990 the nine mines operating in the Northwestern District employed over 1450 people and played a very important economic role in northwestern communities (Figure 2-7). The base metal open-pit mines enjoyed high copper prices for a second straight year; however, the gold mines suffered soft gold and silver prices throughout 1990. The McDame underground deposit at Cassiar was the only new mine to open in northwestern British Columbia.

Cassiar Asbestos closed open-pit operations in June 1990 after operating since 1953. Ore from the pit was stockpiled for milling until the McDame underground deposit came on stream in November. The change from open-pit to underground mining has resulted in some additions to the work force. At McDame, preparations for underground production continued all year, including the relocation of the tramline. Numerous faults in the serpentinite host of the asbestos fibre produces very unstable mining conditions. Working headings in the ore zones require shotcreting round by round, which adds considerably to costs. Markets for the asbestos fibre remained strong throughout the year.

The **Golden Bear mine** experienced a number of start-up problems in 1990. An innovative mill system has required an extended tune-up period. Difficulties with the dry-grind process have been resolved, but problems with the roaster system were still being addressed late in the year. Most of the feed was lower grade oxide ore from the open pit which could bypass the roaster. The objective is to feed the mill equally from both underground and open pit operations. A stockpile from summer mining in the open pit is used during the winter months. Capital costs, initially estimated at $36 million, have now reached $82 million.

The **Johnny Mountain mine** suspended operations in September 1990 because ore reserves were depleted. Skyline Gold Corporation found that the high costs of operating a fly-in operation, coupled with the lower than predicted head grades for the mill, necessitated shutting down the operation. Annual transportation costs were estimated to be $2.4 million. The 318 tonne per day mill has produced 2333 kilograms of gold, 3826 kilograms of silver and 88 984 kilograms of copper from the Stonehouse deposit since beginning production in August 1988

The **Premier Gold project** mined ore from the Dago, S-1, Province and Silbak Premier pits in 1990. Persistent problems with dilution of ore by lower grade rock has affected this operation's profitability. In the second quarter, tonnages were up and the average head grade had kept pace, however, third quarter production slipped. Westmin Mining Limited announced in December that due to persistent adverse technical and economic factors it had been forced to reduce the ore reserves in the Silbak Premier deposit. This will result in reducing both the mill rate from 2300 to 1500 tonnes per day, and the number on staff from 165 to 100 early in 1991. Investigation of potential new ore sources and reconfirmation of existing ore reserves are ongoing.

On the **Lawyers property** in the Toodoggone, Cheni Gold Mines Inc. carried out an aggressive exploration program on the Cliff Creek zone, continued mining the AGB zone, completed a decline on the Cliff Creek zone and built a tote road to the nearby Al property. The AGB zone is expected to be mined out in the spring of 1991. Grades on this zone have been 12 per cent higher than predicted. Underground development of the Cliff Creek zone has been ongoing in order to bring it onstream with depletion of the AGB. Due to differences in sulphide content, ore from the two zones will not be blended. Exploration on the southern extension of the Cliff Creek zone indicated that deposit was smaller than originally thought. As a result Cheni announced in September that it had reduced the Cliff Creek reserves to 755 000 tons of probable and 472 000 tonnes of possible ore.

Nearby, on the **Shasta deposit**, Sable Resources Ltd. began underground development on two levels in order to access both the JM and Creek zones. During the summer ore was trucked about 10 kilometres to the old Baker mill site where it is stockpiled to feed the mill year round. The Baker mill has been modified to run at a reduced rate of 180 tonnes per day with an average head grade of 5.14 grams per tonne gold.

On Newman peninsula in Babine Lake, Noranda Minerals Inc. maintained production at the **Bell mine** near the capacity level of 13 500 tonnes per day with an average head grade of 0.48 per cent copper. Encouraging results from 1990 exploration drilling on the southeast side of the pit are expected to extend the mine life. Drilling at the nearby Granisle pit may lead to the identification of additional reserves for the Noranda Minerals Inc. mill.

At the **Equity Silver Mine** southeast of Houston, production continued at a rate of 8600 tonnes milled per day with an average head grade of 12.10 grams per tonne silver, 1.15 grams per tonne gold and 0.29 per cent copper. Mining continued on the Main zone and, to a small extent, on the Waterline zone. Equity Silver Mines Ltd. has been actively exploring for new reserves within the region as a closure of open-pit operations is anticipated in the fall of 1992. Acid rock drainage is an ongoing problem being addressed by the company. A site-reclamation bond has been posted with the provincial government and negotiations are proceeding to determine the final amount of the bond.